MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

TMA1201 – DISCRETE STRUCTURES AND PROBABILITY

(All sections / Groups)

10 MARCH 2020
2:30 pm – 4:30 pm
(2 Hours)

INSTRUCTION TO STUDENT

1. This question paper consists of 6 printed pages (inclusive of the front page) with 4 questions only. Pages 4 to 6 are appendices for the rules of inference, logical equivalence laws and the Table of Standard Normal distribution.
2. Attempt **ALL FOUR** questions. The distribution of marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. Show **ALL** of your working steps clearly.

QUESTION 1 (10 MARKS)

a) Let A = {a,b,c,d,e,f}, B = {a,c,e,g} and C = {a,b,d,f,,h}

i) Find $A - B$, $B - A$ and $A \Delta B$. [2 Marks]

ii) Find all the subsets of $B - A$. [1 Mark]

b) Given R and S be relations on A = {a,b,c} such that R={(a,a),(a,b),(b,a),(b,b),(c,a),(c,c)} and S={(a,c),(a,b)}.

i) Is R reflexive? Justify your answer. [1 Mark]

ii) Is R symmetric? Justify your answer. [1 Mark]

iii) Is R transitive? Justify your answer. [1 Mark]

iv) Find $S \circ R$. [2 Marks]

c) Let $R = \{ (x,y) \mid x > 2y^2 \}$ be the relation on the set of integers.

i) List at least 2 elements of R. [1 Mark]

ii) Is R a function? Justify your answer. [1 Mark]

QUESTION 2 (15 MARKS)

For the premises and conclusion of the arguments given below, state the premises conclusion, convert the sentences into symbolic logic and state the rule of inference used to obtain the conclusion.

a) "If it is Wednesday, then the supermarket will be crowded. It is Wednesday. Thus, the supermarket is crowded." [4 Marks]

b) You can't access the internet. If you have a new password then you can access the internet. Therefore you don't have a new password. [4 Marks]

c) By using the method of strong induction show that:

10 divides $(n^5 - n)$ for every $n \geq 0$

You may find the following information useful:

$(k + 1)^5 - (k + 1) = [(k - 1) + 2]^5 - [(k - 1) + 2]$ and

$(a + b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$

[7 Marks]

Continued ...

QUESTION 3 (10 MARKS)

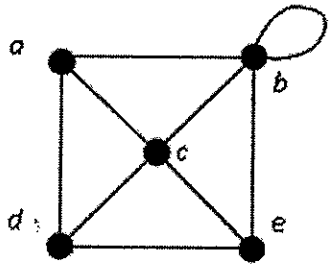
a) (i) Show that $f(n)=2n^7+10n^2+5$ is $O(n^7)$.

[4 Marks]

b) (i) Explain what is meant by a path, Euler circuit and a simple circuit. [3 Marks]

(ii) For the graph shown below, determine whether each of the given walks is a path, cycle or a simple circuit by completing the table below with Y (Yes) or an N (No).

		Path	Cycle	Simple Circuit
I	(a,b,c,d,e)	Y	N	N
II	(a,d,c,d,e,b)			
III	(b,a,c,e,b,b)			



[3 Marks]

QUESTION 4 (15 MARKS)

[**Important:** Calculators are not allowed in questions 4(a) and 4(b). You must show proper steps on how to simplify and compute your answers.]

a) Three coins are tossed, find the probability of getting at least 2 heads. [2 Marks]

b) A bag contains 4 white,5 red and 7 black balls. What is the probability that three balls drawn at random are all red ? [4 Marks]

c) Find the probability of drawing a card from a well shuffled pack such that the drawn card is either a king or queen. [4 Marks]

d) If the sum of the mean and the variance of a binomial distribution of 5 trials is 4.8, determine the distribution in the form ${}^nC_r\ p^r q^{n-r}$. [5 Marks]

End of Questions

Appendix I

List of Rules of Inference

ADD : $p \Rightarrow (p \vee q)$

SIMP : $[p \wedge q] \Rightarrow p$

CONJ : $p \wedge q \Rightarrow (p \wedge q)$

MP : $[(p \rightarrow q) \wedge p] \Rightarrow q$

MT : $[(p \rightarrow q) \wedge (\neg q)] \Rightarrow \neg p$

HS : $[(p \rightarrow q) \wedge (q \rightarrow r)] \Rightarrow (p \rightarrow r)$

DS : $[(p \vee q) \wedge (\neg p)] \Rightarrow q$

RES : $[(p \vee q) \wedge (\neg p \vee r)] \Rightarrow (q \vee r)$

List of Logical Equivalence Laws

Conversion of Implication: $p \rightarrow q \Leftrightarrow \neg p \vee q$

Conversion of Equivalence: $p \leftrightarrow q \Leftrightarrow (p \rightarrow q) \wedge (q \rightarrow p)$

Double Negation: $\neg \neg p \Leftrightarrow p$

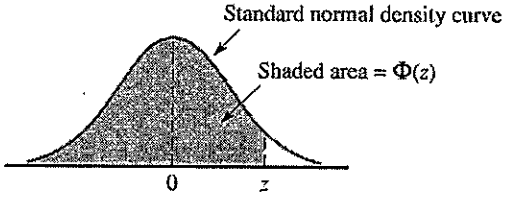
DeMorgan	:	(i)	$\neg (p \wedge q) \Leftrightarrow (\neg p \vee \neg q)$		
		(ii)	$\neg (p \vee q) \Leftrightarrow (\neg p \wedge \neg q)$		
Domination	:	(i)	$p \wedge F \Leftrightarrow F$	(ii)	$p \vee T \Leftrightarrow T$
Negation	:	(i)	$p \wedge \neg p \Leftrightarrow F$	(ii)	$p \vee \neg p \Leftrightarrow T$
Identity	:	(i)	$p \wedge T \Leftrightarrow p$	(ii)	$p \vee F \Leftrightarrow p$
Commutative	:	(i)	$p \wedge q \Leftrightarrow q \wedge p$	(ii)	$p \vee q \Leftrightarrow q \vee p$
Idempotent	:	(i)	$p \vee p \Leftrightarrow p$	(ii)	$p \wedge p \Leftrightarrow p$
Distributive	:	(i)	$p \wedge (q \vee r) \Leftrightarrow (p \wedge q) \vee (p \wedge r)$		
		(ii)	$p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$		
Associative	:	(i)	$p \vee (q \vee r) \Leftrightarrow (p \vee q) \vee r \Leftrightarrow p \vee q \vee r$		
		(ii)	$p \wedge (q \wedge r) \Leftrightarrow (p \wedge q) \wedge r \Leftrightarrow p \wedge q \wedge r$		
Absorption	:	(i)	$p \vee (p \wedge q) \Leftrightarrow p$		
		(ii)	$p \wedge (p \vee q) \Leftrightarrow p$		

Continued ...

Appendix II Standard Normal Curve Areas

Standard Normal Curve Areas

$\Phi(z) = P(Z \leq z)$



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0017	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0038
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0352	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0722	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3482
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Continued ...

Standard Normal Curve Areas

$\Phi(z) = P(Z \leq z)$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9278	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

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